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Remarks

This Amendment and Remarks is being filed in response to the Office Action of January 31, 2008. The claims have not been amended.

Claims 2-4 are pending. These claims are presently rejected over Kawajiri et al. (US 5,719,318), in view of Brockwell et al. (US 6,492,548), further in view of Chaturvedi et al. (US 2002/0065431). This rejection is the same as that found in the last Office Action, except that the reference of Chaturvedi has been added.

In particular, the Office Action states:

Therefore it would be prima facie obvious to one of ordinary skill in the art at the time of the invention, to use the two step process of Brockwell et al. in the oxidation of propylene to form acrylic acid, instead of the single step process of Kawajiri et al. to oxidize acrolein to form acrylic acid, along with using Chaturvedi et al.'s catalyst precursor for the catalyst supply source. One of ordinary skill in the art would be motivated to combine these references, with the reasonable expectation that catalyst activity and the overall yield of the product would be enhanced. The expected result would be the efficient oxidation of propylene to first acrolein and then to acrylic acid, as the final product, in high yield.

As to Kawajiri, as pointed out by the Examiner, indeed Kawajiri discloses that "The catalytic particles used in the present invention can be produced by any of various processes ordinarily used in production of such catalyst particles. The starting materials used in production of the catalyst particles are not particularly restricted..." (column 2, lines 56-60). However, as already stated in previous Amendment and Remarks, from such a disclosure, a skilled artisan could not easily have thought of a feature of the process of the present invention, that is, the use of a catalyst which is

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prepared via a composite of element A (= at least one element selected from among cobalt, nickel, iron, lead and bismuth) and at least one element selected from among molybdenum, vanadium and copper (hereinafter this at least one element selected from among molybdenum, vanadium and copper is referred to as element Mo/V/Cu, and the composite of these elements A and Mo/V/Cu is referred to as composite A-(Mo/V/Cu)) wherein the composite A-(Mo/V/Cu) is beforehand prepared as a supply source of element A for preparing the catalyst.

As also already stated in previous Amendment and Remarks, the art of Kawajiri is featured by how to place (arrange) catalyst particles in a reaction tube (i.e. placing (arranging) catalyst particles in a reaction tube in such a manner that the volume of catalyst particles becomes smaller from the gas inlet side to the gas outlet side), whereby effects can be obtained such that: the temperature of hot spots can be kept lower, and the safety can be ensured, and the catalyst life time can be prevented from shortening. In contrast, the process of the present invention is featured by the use of a catalyst which is prepared via composite A-(Mo/V/Cu) which is beforehand prepared as a supply source of element A for preparing the catalyst, whereby effects can be obtained such that: acrylic acid can be produced in a high yield for a long time since, even under conditions where hot spots are formed, the catalyst is excellent in all of activity, selectivity, and catalyst life time and displays stable performances for a long time (paragraphs [0061]-[0062] of the published present application). Such a catalyst or its effects are not disclosed or suggested in Kawajiri.

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Furthermore, the present application specification discloses in paragraphs [0005] to [0008] of the published present application the following prior art problems:

a catalyst is exposed to high temperature (at hot spots formed) to sublime a molybdenum component, so that catalytic performances are deteriorated; and as methods for solution of this problem, there are proposed methods for preventing the hot spots from becoming too high temperature, but, even in these methods, the hot spots are still formed, and therefore these methods can never be said to be thorough solutions of the above problem, so that it is difficult to completely eliminate the hot-spot formation in the production of acrylic acid by a catalytic gas phase oxidation reaction of acrolein.

Then, as a means of solving these problems, the process of the present invention uses a catalyst which is prepared via composite A-(Mo/V/Cu) which is beforehand prepared as a supply source of element A for preparing the catalyst. As a result, the stability of the molybdenum is enhanced (paragraph [0028] of the published present application), so that there can be obtained the aforementioned effects such that: acrylic acid can be produced in a high yield for a long time since, even under conditions where hot spots are formed, the catalyst is excellent in all of activity, selectivity, and catalyst life time and displays stable performances for a long time.

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Accordingly, there are clear differences between the claimed process and the Kawajiri process which has objects such as to keep the hot-spot temperature lower.

As to the Brockwell reference, as discussed in previous Amendment and Remarks, this reference discloses using only a commercially available product as the acrolein-to-acrylic acid catalyst (column 6, lines 63-65 and columns 9 and 10 (Examples)) and even does not disclose or suggest any catalyst production process. Therefore, the catalyst as disclosed in Brockwell appears to also be produced by conventional catalyst production processes similarly to Kawajiri, that is, not via any catalyst precursor (composite).

The Examiner objects in the paragraph bridging pages 4 and 5 of the Office Action that Chaturvedi discloses a process for producing acrylic acid using a catalyst having the same composition as that of a catalyst used in the present invention and further discloses that the catalyst of Chaturvedi is prepared from a catalyst precursor. However, there are the following differences between the claimed process and the Chaturvedi process.

Preliminary, the attention of the Examiner is respectfully drawn to Exhibit A, attached at the end of this Amendment and Remarks. Exhibit A is a side by side comparison of the Chaturvedi process and the process of the present invention.

Firstly, in the process of the Chaturvedi reference, the starting material for production of acrylic acid is an alkane or a mixture of an alkane and an alkene and is not

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acrolein (Kawajiri and claim 2 of the present application) or propylene (claim 3 of the present application). In addition, in the working examples as disclosed in Chaturvedi, acrylic acid is only produced from propane. Therefore, the reaction itself differs between the claimed process and the Chaturvedi process. Therefore, a skilled artisan would not have had a motive to apply the catalyst of the Chaturvedi reference to the process of the Kawajiri reference which produces acrylic acid from acrolein.

Secondly, indeed Chaturvedi discloses that a catalyst is prepared from a catalyst precursor (paragraphs [0049] to [0053] or [0054] to [0058] of Chaturvedi), and the Examiner may possibly consider that this catalyst precursor can contain the composite A-(Mo/V/Cu) as used in the present invention as a supply source of element A for preparing a catalyst. However, as explained below, the "catalyst precursor" as referred to in Chaturvedi cannot contain the composite A-(Mo/V/Cu) as used in the present invention as a supply source of element A for preparing a catalyst. Because, as explained below, there are great differences between a preparation process of a catalyst from a catalyst precursor in Chaturvedi ("using Chaturvedi et al.'s catalyst precursor for the catalyst supply source" on page 5, lines 8-9 of the Office Action) and a preparation process of a catalyst via composite A-(Mo/V/Cu) beforehand prepared as a supply source of element A for preparing the catalyst in the present invention.

Hereinafter, differences between the catalyst preparation process of Chaturvedi and that of the present invention are explained by referring to Figs. 1 and 2

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(enclosed as Exhibit A) which are flow charts for illustrating these processes respectively.

Firstly, as to the catalyst preparation process of Chaturvedi, Chaturvedi discloses in paragraphs [0049] to [0053] or [0054] to [0058] (for more detail, paragraphs [0071] to [0080]) that a catalyst is prepared by a process, as shown in Fig. 1 on the enclosed Exhibit A, comprising the following steps of

(1) mixing compounds of elements (i.e. starting materials for elements) and a solvent to form a starting material mixture (paragraph [0050] or [0055] (for more detail, paragraph [0071]) of Chaturvedi);

(2) removing the solvent from the starting material mixture (i.e. drying the starting material mixture) to obtain a catalyst precursor (paragraph [0052] or [0057] (for more detail, paragraph [0074]) of Chaturvedi); and

(3) calcining said catalyst precursor to obtain said catalyst (paragraph [0053] or [0058] (for more detail, paragraphs [0075] to [0080]) of Chaturvedi).

From this disclosure, it can be understood that in Chaturvedi the dried material as obtained in the drying step (2) just before the calcining step (3) as the final treatment for obtaining a catalyst is referred to as "catalyst precursor".

On the other hand, in the present invention, a catalyst is prepared by a process, as shown in Fig. 2 in Exhibit A, comprising the following steps of:

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(a) beforehand preparing a composite A-(Mo/V/Cu) as a supply source of element A, by such as uniting a starting material for element A and a starting material for element Mo/V/Cu and then optionally drying the united material and then optionally heating the dried material (paragraph [0027] of the published present application);

(b) mixing the composite A-(Mo/V/Cu) and starting materials for the other elements to obtain a starting material mixture containing the composite A-(Mo/V/Cu);

(c) drying the starting material mixture to obtain a dried material; and

(d) calcining the dried material to obtain said catalyst.

Thus, in the present invention, the composite A-(Mo/V/Cu) is beforehand prepared as a supply source of element A and thereafter mixed with the starting materials for the other elements. However, Chaturvedi does not disclose or suggest such a beforehand preparation of the composite A-(Mo/V/Cu) as a supply source of element A before mixed with the starting materials for the other elements.

Hereupon, based on the aforementioned definition of the "catalyst precursor" as referred to in Chaturvedi such that the dried material as obtained in the drying step (2) just before the calcining step (3) as the final treatment for obtaining a catalyst is referred to as "catalyst precursor", it may be objected such that the dried material as obtained in the drying step (c) just before the calcining step (d) as the final treatment for obtaining a

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catalyst in the above catalyst preparation process of the present invention corresponds to the "catalyst precursor" as referred to in Chaturvedi. However, from the above recitation of the steps of the catalyst preparation process of the present invention, it can be understood that the dried material as obtained in the drying step (c) just before the calcining step (d) as the final treatment for obtaining a catalyst in the above catalyst preparation process of the present invention is a dried material of the starting material mixture containing the composite A-(Mo/V/Cu) as a supply source of element A, and therefore contains the composite A-(Mo/V/Cu) as a supply source of element A. In contrast, the "catalyst precursor" as referred to in Chaturvedi cannot contain such a composite A-(Mo/V/Cu) as a supply source of element A, because, as aforementioned, Chaturvedi does not disclose or suggest the beforehand preparation of the composite A-(Mo/V/Cu) as a supply source of element A before mixed with the starting materials for the other elements.

Incidentally, in the working examples as described in the present application specification, the term "precursor" is also used such as "Fe-Mo precursor" (Examples 1, 2), "Fe-Cu-V precursor" (Example 3), and "Bi-Mo precursor" (Example 4). However, from the disclosures of these Examples, it can be understood that the "precursors" in these Examples are the above-explained composites A-(Mo/V/Cu) which are beforehand prepared as a supply source of element A and thereafter mixed with starting materials of the other elements and then dried and then calcined to obtain catalysts. Therefore, the "precursors" in the above Examples of the present

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invention are not the "catalyst precursor" as referred to in Chaturvedi which according to the aforementioned definition of the "catalyst precursor" in Chaturvedi is a dried material as obtained in the drying step (2) just before the calcining step (3) as the final treatment for obtaining a catalyst.

Due to the above-explained differences between the catalyst preparation process of the cited prior art and that of the present invention, the catalyst of the present invention has a structure different from those of the cited prior art catalysts. Therefore, the catalyst of the present invention provides prominent effects in the production of acrylic acid when compared with the cited prior arts.

The prominent effects of the present invention are demonstrated by Examples and Comparative Examples as described in the present application specification. The Examples use catalysts prepared by the above-explained process according to the present invention as shown in Fig. 2 which involves the beforehand preparation of composite A-(Mo/V/Cu) as a supply source of element A. On the other hand, the Comparative Examples use comparative catalysts prepared by the above-explained prior art process as shown in Fig. 1 which does not involve the beforehand preparation of composite A-(Mo/V/Cu) as a supply source of element A. As a result, for example, when the results of the oxidation reactions in the presence of the prepared catalysts are compared between Example 5 and Comparative Example 3 or between Example 6 and Comparative Example 4, then the yields of acrylic acid in

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Examples 5 and 6 are significantly higher than those in Comparative Examples 3 and 4 respectively.

Accordingly, a skilled artisan could not have easily been led to the claimed invention from the cited prior art documents.

A. Housekeeping matters

A.1. Period For Reply

A shortened statutory period for reply was set to expire three months from the mailing date of the Office Action of January 31, 2008. January 31, 2008 plus three months is April 30, 2008. This paper is being filed on or before Wednesday, April 30, 2008.

A.2. Status

The Office Action of January 31, 2008 was nonfinal.

A.3. Disposition Of Claims

Claims 2-4 are pending.

A.4. Application Papers

This case includes no drawings.

A.5. Priority under 35 U.S.C. §§ 119 and 120

Acknowledgement of the claim for foreign priority was made in the Office Action dated March 28, 2007. This is appreciated.

Receipt of the certified copy of the priority document was acknowledged in the Office Action dated March 28, 2007. This is appreciated.

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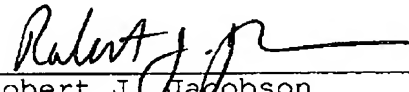
A.6. Attachments

Applicant has filed five PTO-1449 forms in this case, a first and second with the filing of this case on January 26, 2004, a third on August 4, 2004 (stamped as received on August 9, 2004), a fourth on April 11, 2006, and a fifth on October 15, 2006. All of the references on the PTO-1449 forms have been initialed, and all of the PTO-1449 forms have been signed and returned. Such is very much appreciated.

B. Summary

Applicant respectfully submits that the present application is now in condition for allowance. The Examiner is respectfully invited to make contact with the undersigned by telephone if such would advance prosecution of this case.

Respectfully submitted,

Date: 4-4-08
Robert J. Jacobson
Reg. No. 32,419
650 Brimhall Street South
St. Paul, MN 55116-1511Tel. No.: (651) 699-7900
Fax. No.: (651) 699-7901

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